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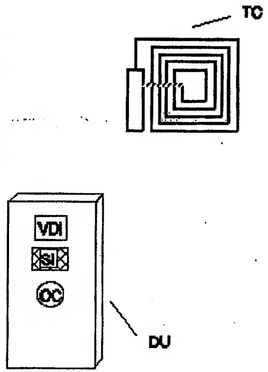

(57) Abstract: The invention relates to an arrangement for observation of state and changes of state of surroundings (OUS) including one or more detection units (DU), which have means for transmitting and receiving energy and means for observing some characteristics of received energy, such characteristics include for example oscillation frequency, amplitude and time dependence of signal, one or more transducer device (TC) which is having at least partially electrical interaction, such as galvanic, capacitive or inductive interaction, with surroundings (OUS) and means for receiving energy transmitted by detection unit (DU) in such a way, that transducer device (TC) is arranged through shape, medium (SL) or electrical coupling mode to be coupled in different ways to surroundings and transducer device (TC) is arranged to transmit for example via electrical coupling some information related to surroundings (OUS) to detection unit (DU).

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An arrangement for making versatile observations from surroundings

The object of the invention is an arrangement for the detection of changes in ambient and states of ambient, for example detecting factors of interest, such as moisture in the structures of buildings and in diapers of infants and chronics. Other applications involve temperatures above or below allowed limits, movement in structures due to e.g. fatigue of materials, etc.

In practice many situations occur where it is of benefit to detect changes in the surroundings. Examples of such situations are

- Detection of moisture accumulating in the structures of buildings. The accumulation of moisture in the structures of buildings can lead to damage in the structures due to rust or rot. Moisture may also lead to growth of mould fungus, which is a serious health hazard.
Moisture damage to buildings has been found to be quite common. Moisture damages occur in as many as 55% to 90% of residential buildings. Visible mould fungus is found in approximately one third of the houses built after 1950. Mould fungus spores have been found to be highly allergenic. Various studies have estimated that as many as 50% of asthmatic persons are allergic to moulds. Mould spores also increase the susceptibility of exposed persons to catch respiratory diseases caused by viruses and bacteria.

- Detection of the need to change diapers on chronics and infants. The changing of diapers used for chronics and infants presents much work for the nursing staff. If the wetting of diapers could be detected easily, diapers would not be changed unnecessarily, and, on the other hand, a quick response could be made to the need for changing. Thus the quality of nursing could be improved easily while reducing work and costs. Several solutions to detecting moisture in diapers and indicating the need for changing have been developed, requiring either wiring or installation of a device in the clothes close to the diaper or the bed. The solutions have proved inconvenient in practice. Such solutions are described e.g. in references US 5,392,032, US 5,291,181 and US 4,539,559.

- Movement in buildings can sometimes lead to breaks in / failure of critical structures, which in turn may lead to serious consequences or considerable increase in repair costs, if the breaks are not observed in time.

Temperatures above or below allowed limits can cause damage to goods e.g. during transport. There must be a means to show later whether the specified temperature limits have been violated during transport.

One solution for the problems mentioned above is presented in the reference Sepponen FI 100138.

With the invention described in the reference one observes surroundings using transducer means, which is having at least partially an electrical interaction with surroundings. However, with the solutions of prior art one cannot solve in a satisfactory way the problems described in following.

In practice there exist situations where the change to be observed is relatively far from the transducer means. In addition there exist situations, where one wants some information about the strength or nature of the change. As an example of a problem like this is monitoring of a diaper of a chronically ill patient, when one needs to know if there are either faeces and/or urine.

Patients, who have very sensitive skin, are those suffering from e.g. infection caused by bacteria or virus, diabetes, allergy, suppressed immunity or poor blood circulation. In addition skin of a baby may irritate in such a way that a change of a diaper must be done immediately after urination or defecation.

Bed-wetting patients form a distinct group, which is treated successfully with moisture alarm system, which wake up a patient as soon as a bed-wetting takes place. The method is the better the more sensitive it is. In other words an alarm is needed immediately after beginning of urination.

In the reference mentioned there is not described any means to affect the direction of the observation.

In practice there exist cases, in which one wants to know e.g. moisture from one direction but from other directions. Such situations exist among others in monitoring of moisture in buildings.

Also the reference FI 100138 does not include any means to affect on the sensitivity and/or selectivity of the transducer means. Under the circumstances by using the known technique one cannot offer a satisfactory solution for the problem situations mentioned above.

The arrangement according to this invention enables the detection of changes in ambient conditions in a versatile manner, and the solving of problems similar to those described above.

Characteristic features of the arrangement of the invention are indicated by the characterising parts of the claims.

The invention is illustrated in the accompanying drawings, where

- Fig. 1 shows an arrangement according to the invention, with a transducer device and a detection unit,
- Fig. 2 shows different embodiments of the transducer device
- Fig. 3 shows the connection of a possible embodiment of the detection unit,
- Fig. 4 shows the operating sequence of the detection unit and the detection signals in two different cases, and
- Fig. 5 shows the use of an arrangement according to the invention in monitoring moisture in a diaper or in a bed of a person, such as a patient or a baby, in such a way that the detection device is connected to a central monitoring room.
- Fig. 6 shows a transducer device including a circuit L and C on a substrate B, whose properties affect the properties, such as sensitivity for certain changes in ambience, of the transducer device.
- Fig 7. shows a transducer device, which includes components L, C and B and particular components SW (Sensing Wires), which are realised in such a way that the changes in ambience affecting them affect also properties of the transducer device.
- Fig. 8 shows two transducer devices which have a specific intermediate layer SL (Sensing Layer), which affects on the properties of the transducer device and which is affected by properties of the object under study OUS (Object Under Study), the properties of SL can be dependent on time, place or on other variable or a combination of those, in the transducer devices in the figure the other include a spatially esstentially homogenous SL and the other include SL which has properties which are spatially dependent.
- Fig. 9 shows a transducer device, which has in addition to a layer SL another layer FILL, whose properties affect for their part on the properties of the transducer device.
- Fig. 10 shows a transducer device, which includes as an example three circuits C1, L1, and C2, L2, in the example case of the figure these circuits are connected with a cable
- Fig 11 shows a transducer device, which includes as an example three circuits, in this case resonance circuits, the first circuit L1, C1 on a substrate B1, The second circuit L2, C2, on a substrate B2 and the third circuit L3, C3, on a substrate B3, circuit L1 and L2 are coupled together electrically, for example via mutual inductance M12, and circuits L1 and L3 are coupled together electrically, for example via mutual inductance M13.
- Fig 12 shows as an embodiment of the invention a diaper SN (Sanitary Napkin), which includes a detection device TC1 for monitoring of accumulation of moisture and a detection device TC2 for detecting faeces.

Fig. 1 shows the main parts of an arrangement according to the reference FI 100138: TC (Transducer Circuit) is a transducer device, which can be a resonance circuit formed by a capacitance and an inductance and oscillating at a specific frequency fi. As known, the specific frequency fi is obtained from the equation fi = $1/(2\pi\sqrt{LC})$. DU (Detection Unit) is a detection unit, which may be hand-held, containing, associated with the operation, an operating control OC (Operation Control), which can be e.g. a push-button, and further containing indication devices, for example SI (Sound Indicator) is a sound indicator and VSI (ViSual Indicator) a visual indicator device such as a signal light (lamp, light-emitting diode, liquid crystal display, or the like.). Naturally the detection unit can be connected through wires or wirelessly to a central unit in a control room, or through a telephone device to wireless pagers, a radio telephone apparatus (e.g. GSM, NMT), etc.

According to the invention TC is in an electrical coupling between surroundings to be observed. In following an electrical coupling is conductive, or capacitive or inductive coupling or coupling via electromagnetic radiation or coupling via any combination of the said couplings and furthermore a conductive coupling may mean either metallic (via electrons) or electrolytic (via ions) coupling.

Fig. 2 shows some embodiments of transducer TC. In the embodiments shown, TC can contain a resonance circuit consisting of a coil L and a capacitor C. The components L and C can be implemented e.g. with the same technology as transducer components in modern burglar alarms. Such solutions and also solutions associated with the implementation of detection units are shown e.g. in reference US 5,381,137. These solutions can be applied in arrangements according to the present invention. TC may be realised also by using printed circuit technology, which is commonly used in electronics devices. In this way one may produce different shapes and sizes at low costs without significant tooling costs. TC may be even a printed circuit board with multiple layers and the circuits of TC may be realised on different layers. In this way a transducer circuit may have one or more sensing elements SE. In Fig. 2b, for example, SE is a thin metal foil, which short-circuits several turns of coil L. If foil SE breaks or is gradually displaced due to e.g. an electrochemical process, the inductance of L increases and the resonance frequency of the circuit decreases.

In Fig. 2c SE is placed in one of the two electrodes of a capacitor; in this case a breaking of SE or a displacement of SE due to an electrochemical process causes a reduction of capacitance C and an increase in the resonance frequency. SE may also break the transducer-circuit coil L. Then there will naturally be no resonance frequency of the circuit.

Fig. 3 shows a possible connection of DU detection electronics as described in the reference FI 100138. The figure shows only a part of the electronics in DU. For instance power sources, display components, audio signal components, and any components associated with external central units are not shown. EDC (Excitation/Detection Coil) is a coil into which pulse generator PG, controlled by the GATE signal, applies a current pulse through amplifier EA (Excitation Amplifier). The rapidly rising edge of the current pulse starts an oscillation in the nearby transducer(s) TC (not shown in Fig. 3) at its/their specific frequency/frequencies.
This oscillation induces in EDC a signal, which is connected through capacitor C to preamplifier PA and band-pass amplifier BPA. After BPA, there is a peak detector, which during the pulse is reset under the control of the GATE signal. A comparator COMP detects the oscillation. If the amplified signal exceeds the reference level VREF, a detection signal DTS is transmitted.
DU can identify TC through it's specific frequency or DU may include means for calculation of frequency spectrum of a signal emitted by TC for example via Fourier transformation or by using some other spectrum analysing method such as autoregressive algorithms or wavelet transformations.

DU may also include memory means to store a received signal and/or some information derived from a signal. By including means in DU for storing also an identification of the detection site for example in a wireless manner by using e.g. TIRIS equipment manufactured by Texas Instruments (USA) or by using some other wired or wireless technique.

Figs. 4a and 4b show, with reference to Fig. 3, an operation sequence (detection sequence). During the GATE signal a current pulse is sent to coil EDC. This pulse is shown on the ICOIL axis. The generated signal is shown on the SIGNAL axis, and the signal detection time after the pulse is DTIME. The operation is illustrated by an example where TC is placed for example in a diaper. When the diaper is dry, TC oscillates for a long time at its specific frequency, because the quality factor (Q-factor) of the circuit is good. Thus during the detection time DTIME a strong signal is detected. When the diaper becomes wet, the resonance circuit of TC is loaded, as urine is a good conductor of electricity, and the quality factor (Q-factor) of the resonance circuit in TC becomes very small. Now the oscillation ceases quickly already during the GATE signal, and no notable signal is detected during the detection time DTIME. Thus DU can without effort be used to check whether a need exists for changing the diaper.

DU may operate also in such a way that the frequency of the oscillator of DU is to be sweeped over that frequency range which includes the resonance frequencies of the circuits of TC. DU detects the loading of the detection coil and when the resonance circuits of TC are coupled to the coil, one detects a corresponding change, which has characteristics, which may be used for measuring for example variables related to the Q-values of the resonance circuits of TC.
TC may include also one or several elements, which have a strong electric nonlinearity, In this case a signal generated by TC from excitation of DU includes harmonics of the fundamental frequency and the circuits of DU are realised in such a way that they are capable to detect at least partially said harmonic frequencies. Such non-linear components can be semiconductor junctions, capacitors, whose dielectric constant of dielectric is dependent on voltage or inductances having a core with permeability dependent on density of magnetic flux. Naturally, in these applications nonlinearity must be rather strong at those levels of voltage and current, at which TC is operating in that application.

Fig. 5 shows schematically an arrangement according to the reference FI 100138, where DU is attached for example to a bed or a pram PB (Patient Bed), the DU energy exchange means EDC, which can be a conductor loop, can be placed under or inside the mattress MT to improve sensitivity. TC, which is not shown in the Figure, is located in a place such as a diaper or clothes of a person P lying on the bed. DU is connected through signal transmission STM (Signal Transfer Mean) to a central observation unit COU (Central Observation Unit). STM may include a wired or wireless connection. STM may include a telephone, radio, ultrasound, light (infrared), or other conceivable communications devices. COU can be in contact with many DUs. Then means can be provided in each DU for transmitting identification information to allow COU to identify the DU transmitting the information. COU may also contain means for monitoring and controlling other quantities. Such quantities may be blood pressure, ECG or movements of P detected by means (e.g. piezoelectric material) provided in mattress MT to convert movements into electric signals. What is meant here by the central observation unit COU is an entity generally associated with observation. It may therefore comprise separate display devices, central units and their controls. Furthermore, the central observation unit COU may consist of many hierarchic units, which form a larger network. Such a network can give the first alarm for example in a local unit, which e.g. in a hospital could cover a single ward, but unless no response is made to the alarm within a preset time, the local unit retransmits the alarm to the hospital's on-duty central control.

In moisture control of buildings a tape-formed TC with an adhesive surface can be used. Such adhesive tape TC can be fastened to structural locations where moisture damage is probable, e.g. under the bathroom floor, besides the piping for underfloor heating, and in kitchen structures. Here it is of benefit to use the SE element, which by an electrochemical process alters some characteristic of TC, e.g., the resonance frequency or the Q-factor. Then TC reacts permanently to long-term exposure to moisture only. The choice of the types and quantities of metals in the SE can regulate sensitivity. The response of TC to short-duration exposure to moisture by e.g. a reduction in the Q-factor of its resonance circuit.

Figure 6 shows a transducer device of the invention, in which a coil L and capacitor C is placed on a substrate B (Base), which is designed so that a for ambient changes sensitive part of a wiring of L is designed so that it may be placed on a desired place. The wires SW (Sensing Wires) of the transducer device according to the figure are connected to the coil L in such a way that the Q value of the resonance circuit formed by L and C is modified by resistance between the wires which is modified e.g. by moisture. A transducer device like this may be used in a following way: The resonance circuit formed by the coil L and the capacitor C is placed near a surface where a detection using a detection unit DU (Detection Unit) can be made. The sensitivity of SW can be made dependent on location so that SW is covered with insulating material such as lacquer, and a sensitive part is at least partially left without covering or is covered with material, which affects the coupling of SW with surroundings. Such material can be as an example water-soluble lacquer, which just after long-term effect of moisture is leaving from the sensitive part and enables the effect of a change in moisture to affect on the properties of TC via the sensitive part.

The sensitive part of SW will be placed in a desired place in the structure to be studied. In this way the high sensitivity of the system is preserved also with objects, which one cannot approach with DU. Another application is a diaper of chronically ill patient, in which case a capacitive coupling to moisture absorbing material senses wetting of the diaper and SW is placed in an area where faeces decreases resistance and the transducer indicates a need for changing the diaper. This is because diapers have a good capability to absorb urine and keep skin of a patient dry, but due to fast irritation of skin by faeces a diaper must be changed immediately. A sensitive area of SW may be large compared to a cross-sectional area of a wire. A TC placed in a diaper is one construction of TC of the invention, in which a coupling may be mainly capacitive (in the example case that part of TC which detects wetting of a diaper) and galvanic (that part, which according top the example detects faeces). A corresponding construction may be used for solution of other problems such as in monitoring of moisture in buildings.

TC may also be placed in means, which are provided for dressing of diaper on a person, such as nappy trousers or linen. In this case TC and the said means for dressing may be either disposable or non-disposable.
TC may also be attached to a doormat, which is used in public buildings and an arrangement described monitors moisturising of a mat and notifies a condition of the mat to a responsible service company about excessive moistening of the mat.

Figure 7 shows more precisely a placement of TC of the invention relative to an object under study OUS (Object Under Study). One may affect on the sensitivity of TC on changes of OUS, such as on changes of moisture, by using a selective layer SL (Selective Layer). SL may prevent effect of changes form known direction on some properties of TC. Because in some realisations of TC, in which a coil L is wire loops placed side by side on a plane and these loops are capacitively coupled to OUS, one may change this coupling by selecting SL with a proper thickness. The thicker SL the weaker is the coupling, and the less sensitive TC is on the changes, which takes place in OUS. Material of SL affects also on the strength of the coupling. If the relative dielectric constant is small the coupling is small, but if the dielectric constant is large then the coupling is large. A very good isolation is achieved if one makes SL by using splitted conductor, which acts as a static shield against one direction. In this case TC is sensitive nearly completely in opposite direction relative to said static shield.
TC may also be splitted in such a way that it includes two or more resonance circuits, from which each has been sensitised to one or more changes of OUS. In addition it is possible that TC includes some structures, which are not sensitive to changes in OUS. These structures may be used for location of TC in parts of a building and in such a way one may clarify for example some effects of moisture on other parts of TC.
Figure 9 shows a solution, where a transducer device includes in addition to base B, circuits L, a layer SL and filling material FILL. By selecting filling material FILL properly, for example a material, which absorbs strongly moisture and SL having permeability only for water vapour (such as Gore-Tex, Gore Inc., USA), TC will become a transducer device, which is suitable for long term monitoring of high relative moisture level. SL may be some other polymer, glass or metal material or a combination of these, which is chemically, through irradiation or mechanically modified to pass water vapour, but because of size of pores or of electric charges of sides of pores unable to pass liquid water or water attached to salt ions. If the circuit L is a pat of a resonance circuit, one may detect via Q-value of the resonance circuit or via a variable proportional to Q value detect strength of exposure of moisture on TC. In other words TC may operate depending on the construction as on/off-type or as a gauge for the strength of exposure of moisture. For example the Q-value may be dependent on moisture and by

measuring the Q-value one may measure moisture prevailing in an area of an object OUS.

As an example is a situation where at least one part of TC is arranged to be independent on at least one parameter of OUS and which may be described as follows: In a building will be placed one or several TC to clarify moisture situations prevailing in construction, although the placement of TC is documented carefully it is still desirable that a location of TC may be pointed despite of moisture. In this case TC may be realised as follows: One part of TC will react for moisture and that part has a specific first resonance frequency (e.g. 8 MHz), another part of TC does not react for moisture and operates at a second resonance frequency. (e.g. 14 MHz). In this way TC may be located by using the second resonance frequency (in this case 14 MHz) and moisture level may be detected using the first resonance frequency (in this case 8 MHz)

The operation frequency of TC will be selected in such a way that it is applicable for the specific purpose as well as possible. For example in some cases the operating frequency should be larger than the above mentioned 8 and 14 MHz, in this case TC may be smaller and a coupling between TC and DU can be more easily realised. If there is between TC and DU some electrically conductive material, it may be beneficial to select significantly smaller operating frequency, e.g. 200 kHz. In this case the permeability of material is much better. DU may also include means to transfer some energy e.g. via electromagnetic fields to transducer means TC and this may be realised at different frequency (e.g. at 200 kHz) as the actual collection of information (e.g. at 8 MHz).

One application where low frequency operation may be beneficial is monitoring of moisture of ground of building e.g. under crawling space. TC would be placed in surface layers of ground and by using DU inside building one can monitor, when moisture level of ground will be so high that a probability of mouldy damages will be high.

Another way to affect on the characteristics of TC via a layer SL in such a way that for example increase of moisture of OUS does not reduce the signal properties of TC, such as Q-value, so that a signal response of TC weakens below a level of detectability. In addition it is beneficial in many cases that TC gives a response for an excitation because then one knows that TC and DU are in a proper condition.

Figure 11 shows a solution for realisation of TC in such a way that it includes the first electric circuit, in the figure as an example a resonance circuit, which includes a coil L1, a capacitor C1 and substrate B1, In addition TC includes a second and third electric circuits, which in figure are represented by resonance circuits L2, C2 on substrate B2 and L3, C3 on substrate B3. The second and third electric circuits are coupled via mutual inductances M12 and M13 to the first electric circuit. The coupling between circuits can be also conductive or capacitive or it may be a combination of the mentioned coupling modes. The number of circuits is not limited to that mentioned above, but it is de-

termined by the need. In the same way the circuits may be coupled to their surroundings in different ways and their realisations can deviate in other ways from each other. In some cases one of the circuits will act as some kind of antenna between DU and other circuits. This circuit can be larger than other circuits and can be placed closer the site where DU observes a state of the circuits.

One example of a use of several electric circuits is shown in figure 12 where the transducer TC1 for detection of moisture in a diaper is placed nearer the outer surface of the diaper SN and a transducer TC2 detecting faeces is placed closer the inner surface of the diaper SN. TC1 and TC2 may be essentially separate transducer elements but in some cases it may be beneficial to make TC1 larger than TC2 and make an arrangement where TC2 is detectable via TC1 due to mutual coupling between the circuits. In this case the detection distance for TC2 is longer than without using TC1. TC1 can also be separate (it is not placed in a diaper) and placed in diaper trousers or diaper linen.

TC may be placed in objects, which are observed, during suitable production phases. So TC may be placed for example in an element of a ready-made house, such as a bathroom element or in a construction already during production. Such a building element or complex monitored with TC enables a production of high quality buildings and monitoring of end product without significant additional costs. In the same way TC can be inserted in diaper, foodstuff, package etc. already during a production phase.

TC may also include an active circuit having various functions, such as memory circuit, in which one may store calibration information for TC, measurement results, measurement times or other information important for detection. The active circuit can also include functions for measurement or functions and means for signal transfer. The active circuit may include e.g. a signal transmitter. Said active circuit can include e.g. means for measurements of temperature or pressure. The active circuit may also take needed energy during a reading period from electromagnetic energy transmitted by DU or by some other energy source. TC may also include an energy source needed by the active circuit, such as a battery and it is also possible that said battery will be charged with energy transmitted by DU or said battery is formed from pairs of materials, which have different electrochemical potential and material connecting these will be electrolyte required by battery due to an effect of moisture. Applications for such TC include e.g. alarm for moisture damages, measurement of temperature of concrete and pressure measurement of a tyre.

In a transducer device TC may include detection means, on which known variable or variables to be observed such as temperature or humidity affect and whose characteristics will change due to this effect in such a way that a change may be detected from energy emitted by the transducer device. Said transducer device can be for example a capacitor, which is changing due to temperature or moisture. This kind of capacitors

are available from many component manufacturers. The detection means may also include a material layer which is consistent or divided in parts and this layer includes material mixture such as wall filler (such as Vetonit 6000), which includes salt or salts having a known characteristics by moisture or polymer having combined with salt or salts. Suitable saltcompounds are used commonly as calibration salts in calibration of humidity transducers. As a detection device may serve also a piece of wood, because it is known that conductance of wood is dependent on moisture.

In the above, only a few embodiments of the arrangement according to the invention are described. Many further embodiments will be evident within the scope of the inventive idea expressed in the Claims.

CLAIMS

1. An arrangement for detecting objects, ambient conditions and changes therein, containing one or more detection units (DU), a detection unit (DU) contains means for transmitting and receiving energy, and means for detection of one or several characteristics of received energy, such as oscillation frequency, amplitude or time dependence of signal, one or more transducer device (TC) coupled at least partially with surroundings (OUS) through electric such as galvanic, capacitive or inductive interaction and having means for receiving energy transmitted by the detection unit (DU) characterized in that the transducer device (TC) is arranged through shape, medium material (SL) or mode of electric coupling to be coupled with different ways to surroundings to be observed and transducer device (TC) is arranged for example via electric coupling to transfer information related to object (OUS) to the detection unit (DU).

2. An arrangement according to Claim 1, characterized in that the energy transmitted by the transducer device (TC) is affected by one or more ambient (OUS) physical or chemical quantities.

3. An arrangement according to any one of the preceding Claims especially for detection of moisture in buildings or diapers, characterized in that one or more part of the transducer element (TC) is placed close to a moistening area.

4. An arrangement according to any one of the preceding Claims characterized in that coupling of the transducer device (TC) is affected by one or more material layer (B, SL) for example in such a way that sensitivity of transducer device is different in different directions or in such a way that sensitivity is arranged to be targeted on moisture of known part of object (OUS)

5. An arrangement according to any one of the preceding Claims, characterized in that in that coupling of the transducer device (TC) is affected by one or more material layer (B, SL), from which at least one (SL) is arranged via selection of material, for example using Gore-Tex material, or processing chemically, irradiation or mechanically polymer, glass or metal compound to be permeable for vaporous water but weakly permeable for liquid water or for water molecules bound with ions.

6. An arrangement according to any one of the preceding Claims, characterized in that the transducer device (TC) is at least partially realised using metallic conductor,

such as copper or aluminium folio, which is on substrate (B), which is essentially electrically non-conductive such as for example fiberglas, plastic or paper.

7. An arrangement according to any one of the preceding Claims, characterized in that transducer device (TC) is composed from more than one electric circuits (TC1, TC2), which are electrically coupled with each other.

8. An arrangement according to any one of the preceding Claims, characterized in that the transducer device (TC) includes parts which are coupled to the object (OUS) differently than some other parts of the transducer device, for example some part of transducer device (SWS) which can be electrically connected to object (OUS) whereas other part is electrically isolated from object (OUS), such a solution may be used for example to detect moistening in diaper and faeces in ways which differs from each other.

9. An arrangement according to any one of the preceding Claims, characterized in that transducer device (TC) includes parts which are coupled with object (OUS) in such a way that changes of object (OUS) do not significantly affect on characteristics of said parts and said parts may be used for localisation of transducer device (TC).

10. An arrangement according to any one of the preceding Claims, characterized in that transducer device (TC) includes a material layer (SL, FILL) on which known change of object (OUS), for example change in moisture, affects in a known way and this change affects on characteristics, such as amplitude, frequency, harmonics of fundamental frequency or observed Q-value, of signal emitted by transducer device (TC). .

11. An arrangement according to any one of the preceding Claims, characterized in that transducer device (TC) includes detection means on which known variable or variables to be observed such as temperature or moisture affect and whose characteristics change due to this effect in such a way that this change may be observed via energy emitted by transducer device, said means for detection may include a capacitor having a capacitance changing by effect of moisture or temperature or integral or in parts divided layer including for example some mixture of substances, such as wall filler, in which one has added salt or salts having known characteristics by moisture or polymer on which one has attached some salt or salts as detection means may serve also a piece of wood.

12. An arrangement according to any one of the preceding Claims, c h a r a c t e r i z e d in that transducer element (TC) includes an active circuit, such as memory circuit, which may store some information related to measurement event, some information related to characteristics of TC, such as calibration information, said active circuit may also include some means related to measurement event such as means for measurement of temperature or pressure.

13. An arrangement according to Claim 12, c h a r a c t e r i z e d in that active circuit of transducer device (TC) takes energy from energy source of TC or from outside energy source of TC from example from detection unit (DU) from which energy may be transferred in a wireless manner using electromagnetic energy transmitted by detection unit (DU).

14. An arrangement according to Claim 12, c h a r a c t e r i z e d in that active circuit of transducer device (TC) takes energy from battery or accumulator, which may be charged using energy from outside source for example using energy transmitted by detection unit (DU) or from source to be activated for example by moisture, in this case battery may be at least partially be formed from materials having different electrochemical potentials and material connecting these through an effect of moisture will develop an electrolyte between said materials having different electrochemical potentials.

15. An arrangement according to any one of the preceding Claims, c h a r a c t e r i z e d in that transducer device (TC) includes more than one electrical, from which at least one, the first circuit is arranged to be coupled with surroundings to be observed and at least a second circuit is arranged to be coupled with detection unit (DU) more effectively than said first circuit.

16. An arrangement according to any one of the preceding Claims, c h a r a c t e r i z e d in that one or more transducer devices are placed in object under study (OUS) such as in a package, building element or diaper during manufacturing phase of object under study (OUS) or of any part of that.

17 An arrangement according to any one of the preceding Claims,

c h a r a c t e r i z e d in that detection unit (DU) which may be for example portable, includes control means (OC), such as push button, using which one enables detection unit (DU) to transmit energy, such as electromagnetic radiation or field, and in addition detection unit (DU) includes signalling means (SI, VI) such as signal light or buzzer, which express to user the status of surroundings (OUS) near transducer device (TC) collected with transducer device (TC), such as information related to bedwetting moisture, temperature, exceeding of temperature limits, movement of constructions, changes in shape or mechanical loading or in general only information about distance between transducer device (TC) and detection unit (DU).

18. An arrangement according to Claim 17,c h a r a c t e r i z e d in that detection unit (DU) includes means to analyse information transmitted by transducer device (TC) such as comparator or signal processor.

19. An arrangement according to any of the Claims 17 - 18,c h a r a c t e r i z e d in that detection unit (DU) includes means to collect and store information related to detection place.

20. An arrangement according to any of the Claims 17 - 19,c h a r a c t e r i z e d in that detection unit (DU) includes means to transmit energy to transducer device (TC) for managing power supply of e.g. memory or of some other active circuit.

21 An arrangement according to any of the Claims 17 - 20,c h a r a c t e r i z e d in that detection unit (DU) is connected via some information transfer connection (STM), wireless, wired or any combination of those, to central observation unit (COU).

22. An arrangement according to Claim 21,c h a r a c t e r i z e d in that central observation unit (COU) include also means for processing and displaying of information related to other variables such as temperature, ECG, movement, blood pressure, and safety.

23 . An arrangement according to any of the Claims 21 - 22,c h a r a c t e r i z e d in that detection unit (DU) includes means to transmit information for identification.

24. An arrangement according to any one of the preceding Claims, c h a r a c t e r i z e d in that it is used for detection of moistening of an article, such as moistening of diaper in care taking of patients or children or moistening of a carpet in public building.

25. An arrangement according to any one of the preceding Claims, characterized in that it is used for detection of changes in constructions such as changes in shape, cumulation of moisture, changes of temperature and detection of vibration.

26. An arrangement according to any one of the preceding Claims, characterized in that it is used for localisation of particles.

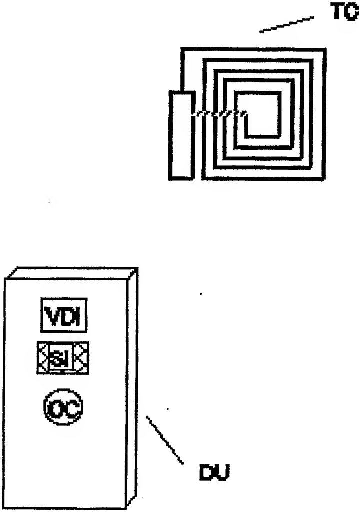

FIG. 1

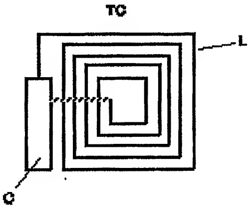

FIG 2a

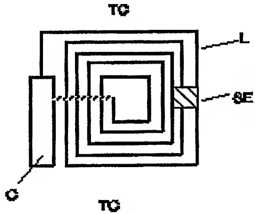

FIG 2b

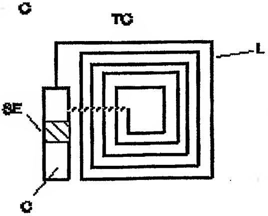

FIG 2c

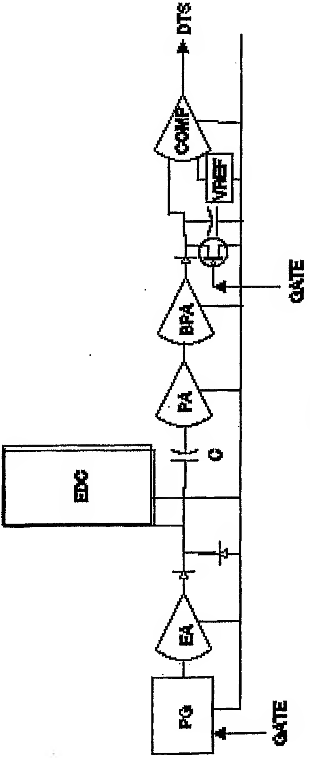

FIG 3

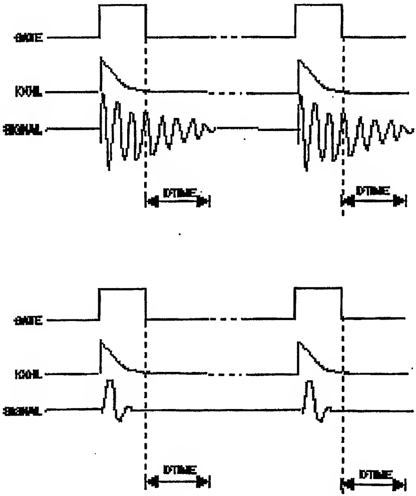

FIG 4

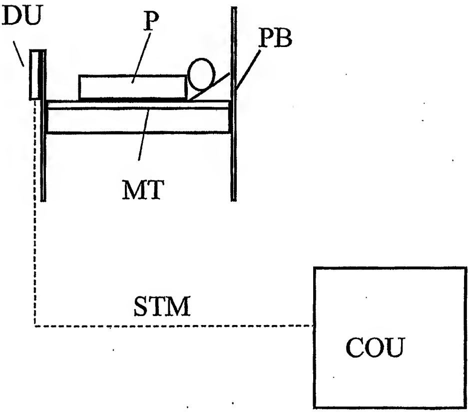

FIG. 5

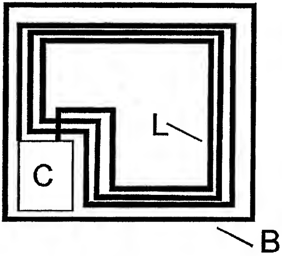

FIG. 6

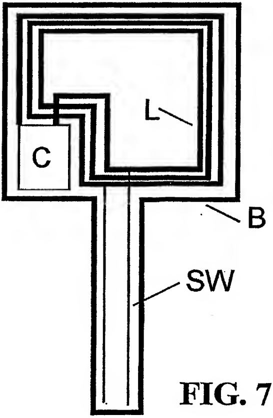

FIG. 7

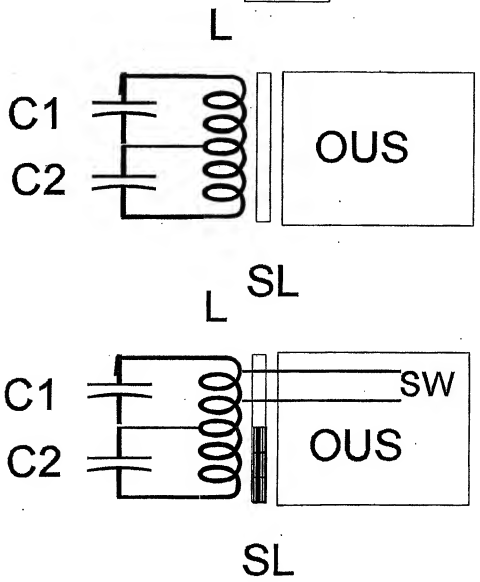

FIG. 8

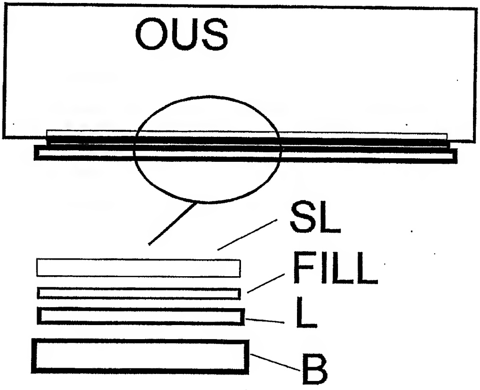

FIG. 9

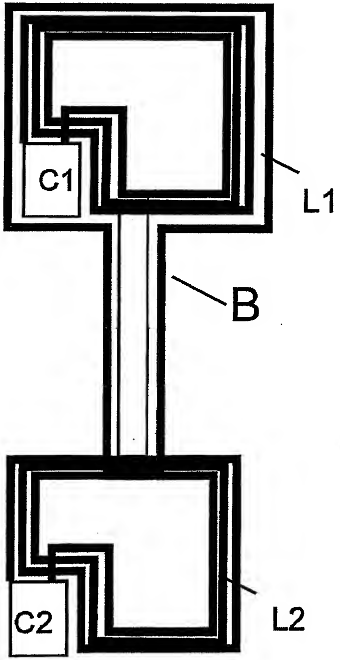

FIG. 10

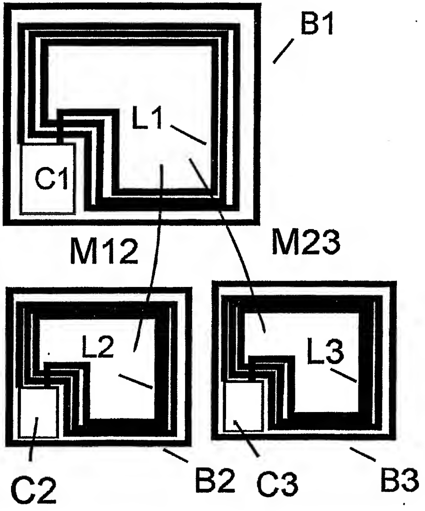

FIG. 11

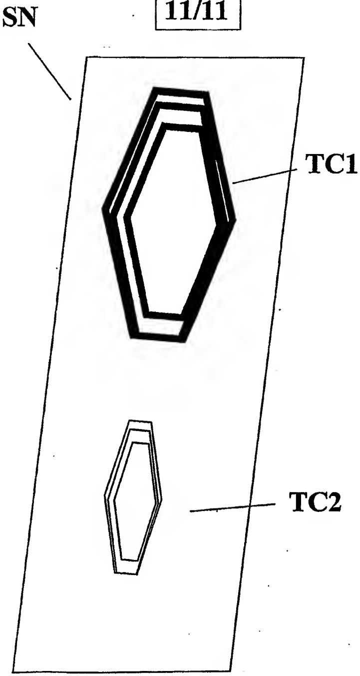

FIG. 12